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TECHNICAL NOTES

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

No. 495

EFFECT OF THE SURFACE CONDITION OF A WING ON THE
AERODYNAMIC CHARACTERISTICS OF AN AIRPLANE

By S. J. DeFrance
Langley Memorial Aeronautical Laboratory

Washington
April 1934

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for Aeronautics
Washington, D. C.



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EFFECT OF THE SURFACE CONDITION OF A WING ON THE AERODYNAMIC CHARACTERISTICS OF AN AIRPLANE

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SUMMARY

In order to determine the effect of the surface conditions of a wing on the aerodynamic characteristics of an airplane, tests were conducted in the N.A.C.A. full-scale wind tunnel on the Fairchild F-22 airplane first with normal commercial finish of wing surface and later with the same wing polished. Comparison of the characteristics of the airplane with the two surface conditions shows that the polish caused a negligible change in the lift curve, but reduced the minimum drag coefficient by 0.001. This reduction in drag if applied to an airplane with a given speed of 200 miles per hour and a minimum drag coefficient of 0.025 would increase the speed only 2.9 miles per hour, but if the speed remained the same, the power would be reduced 4 percent.

INTRODUCTION

With the speed of military and commercial airplanes increasing rapidly, many of the problems of racing airplanes are being encountered in service types, among these problems is the one of surface condition of the wings. As large increases in speed have been claimed for racing airplanes as a result of polishing the surfaces, and also because it has been thought that polishing the surfaces affected the maximum lift, tests were conducted to determine the effect of polishing the wing surfaces upon the aerodynamic characteristics of a small monoplane. The tests were conducted first with the surface of the wing in normal condition and later with the surface highly polished.

the same for both conditions and, since there is practically no correction between 80 and 100 miles per hour, it is probable that the difference in minimum drag coefficient is applicable at the speed of 200 miles per hour.

If a given airplane be assumed to have a top speed of 200 miles per hour and a minimum drag coefficient of 0.025 with a wing surface similar to that of the original wing on the Fairchild F-22, polishing the wing to the same smoothness used for these tests would increase the top speed only 2.9 miles per hour. This is a small increase in speed, but if the top speed of the airplane were to remain the same, the power would be reduced by 4 percent.

CONCLUSIONS

The conclusions to be drawn from the investigation are that: Polishing the wing had a negligible effect upon the lift characteristics but reduced the minimum drag coefficient of the airplane by 0.001. If this reduction in drag were applied to an airplane with a given speed of 200 miles per hour and a minimum drag coefficient of 0.025, the speed would be increased only 2.9 miles per hour, but at the same speed it would permit a reduction in power of 4 percent.

Langley Memorial Aeronautical Laboratory,
National Advisory Committee for Aeronautics,
Langley Field, Va., April 5, 1934.

REFERENCE

1. DeFrance, Smith J.: The N.A.C.A. Full-Scale Wind Tunnel.
T.R. No. 459, N.A.C.A., 1933.

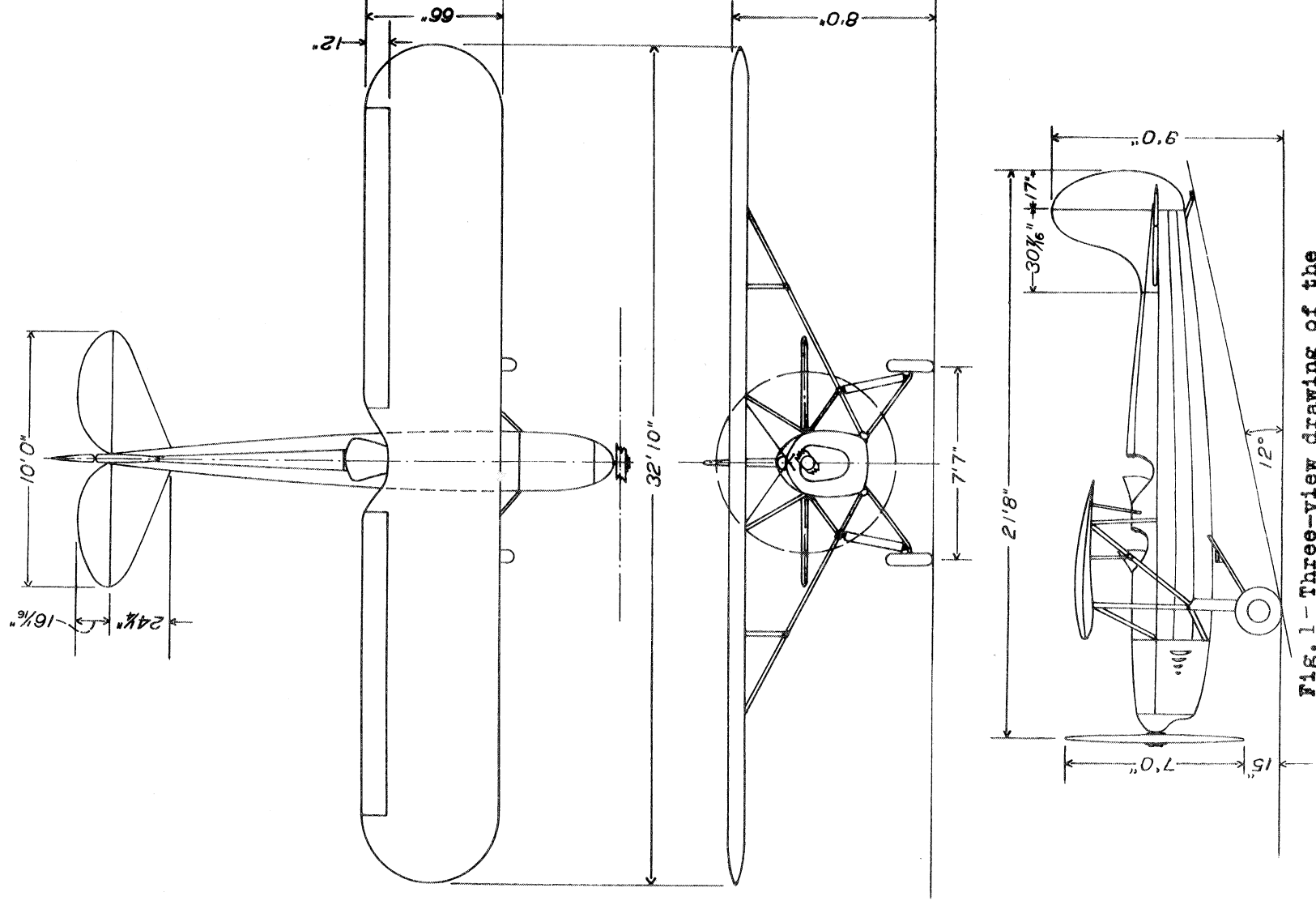


Fig. 1- Three-view drawing of the Fairchild F-22 airplane.

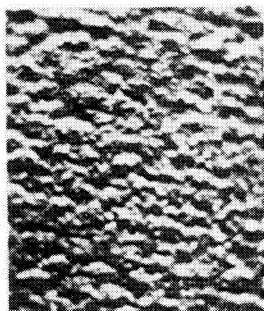


Figure 2.-
Photo-
micro-
graph of
original
surface of
wing (10X)

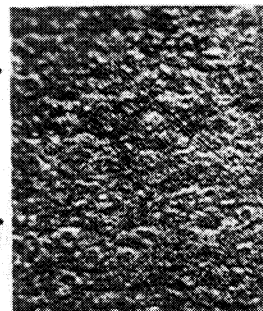


Figure 3.-
Photo-
micro-
graph of
polished
surface of
wing (10X)

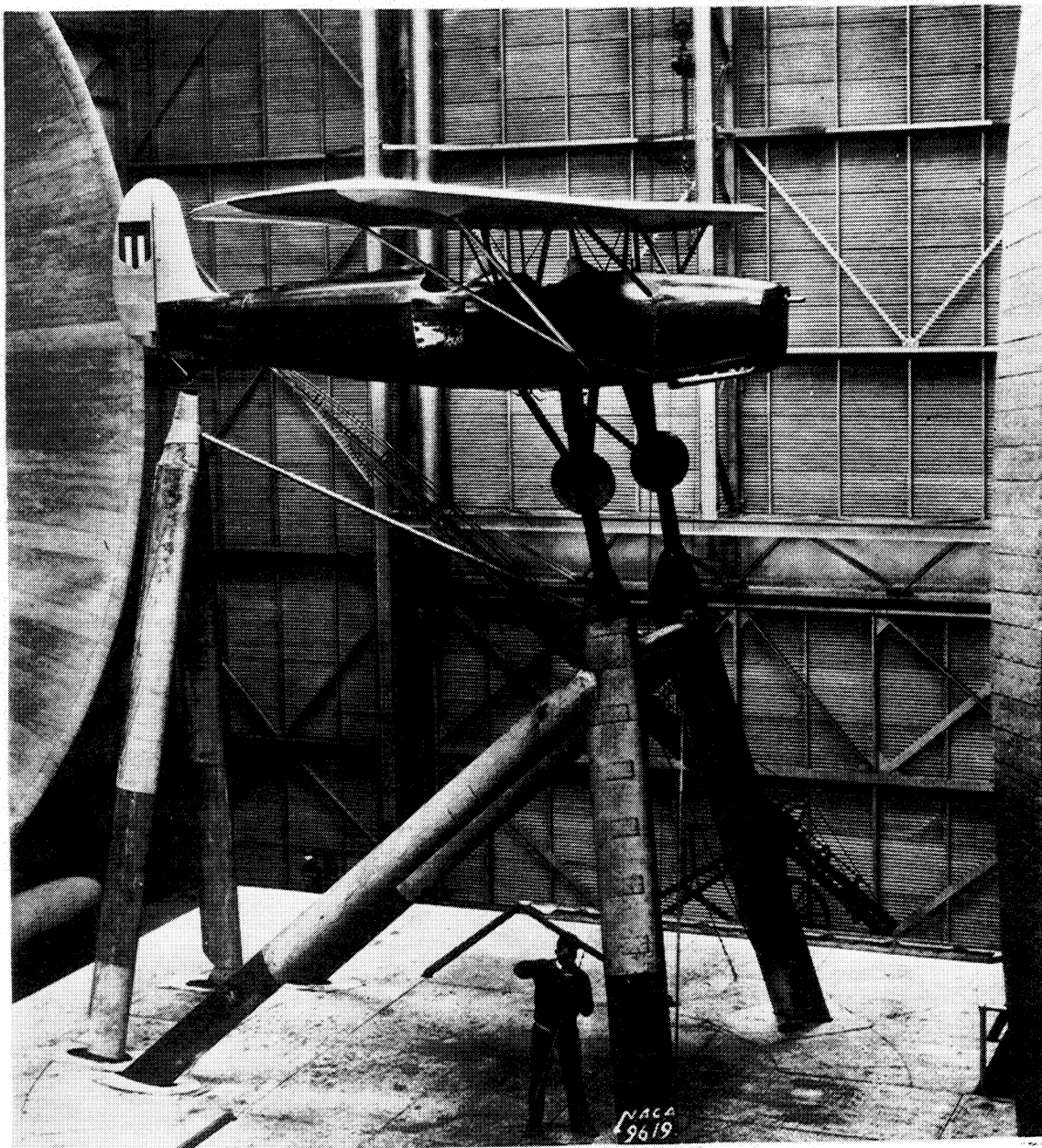


Figure 4.-Fairchild F-22 airplane mounted in full-scale tunnel.

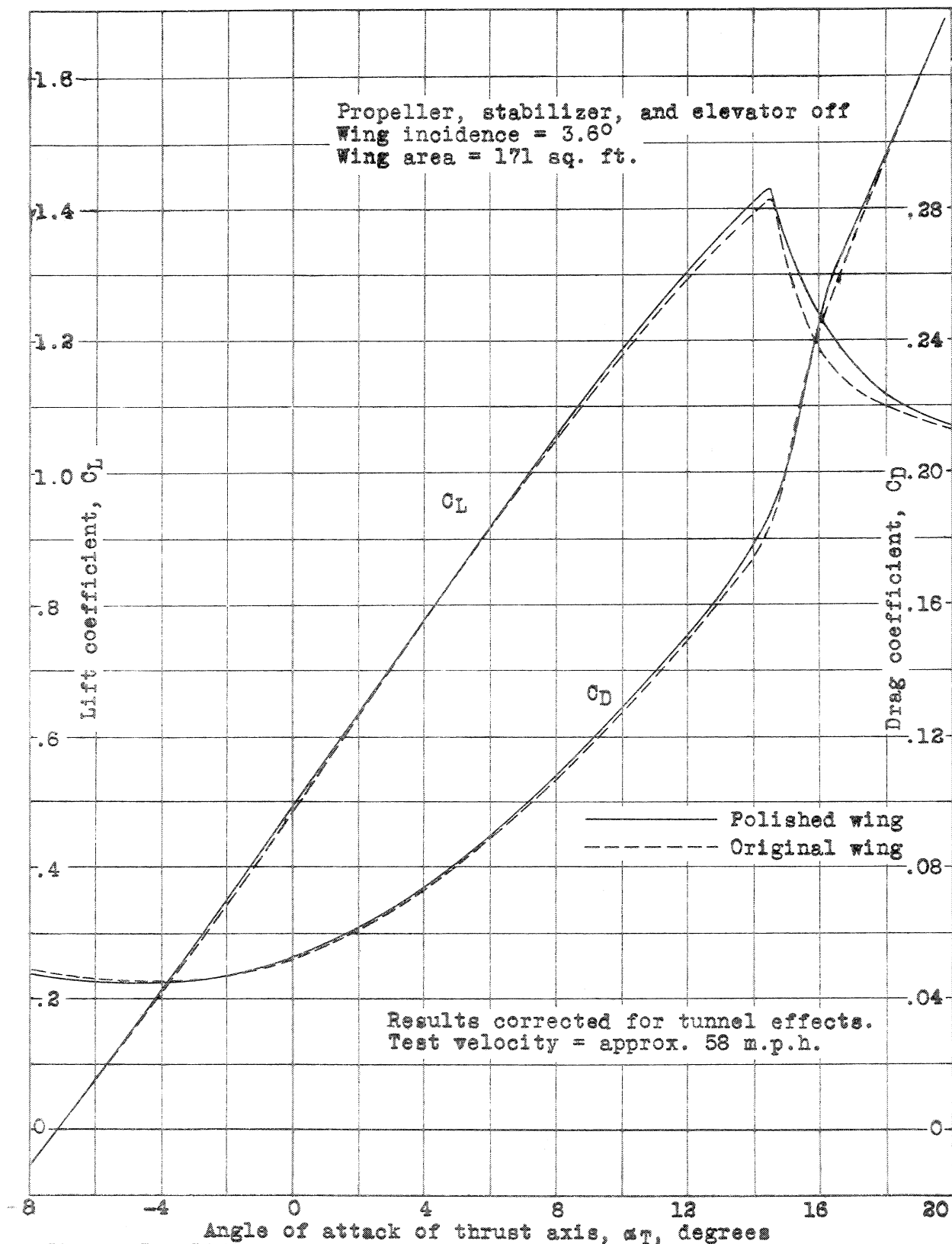


Figure 5.- Lift and drag characteristics of Fairchild F-23 airplane with original and polished wing surfaces.

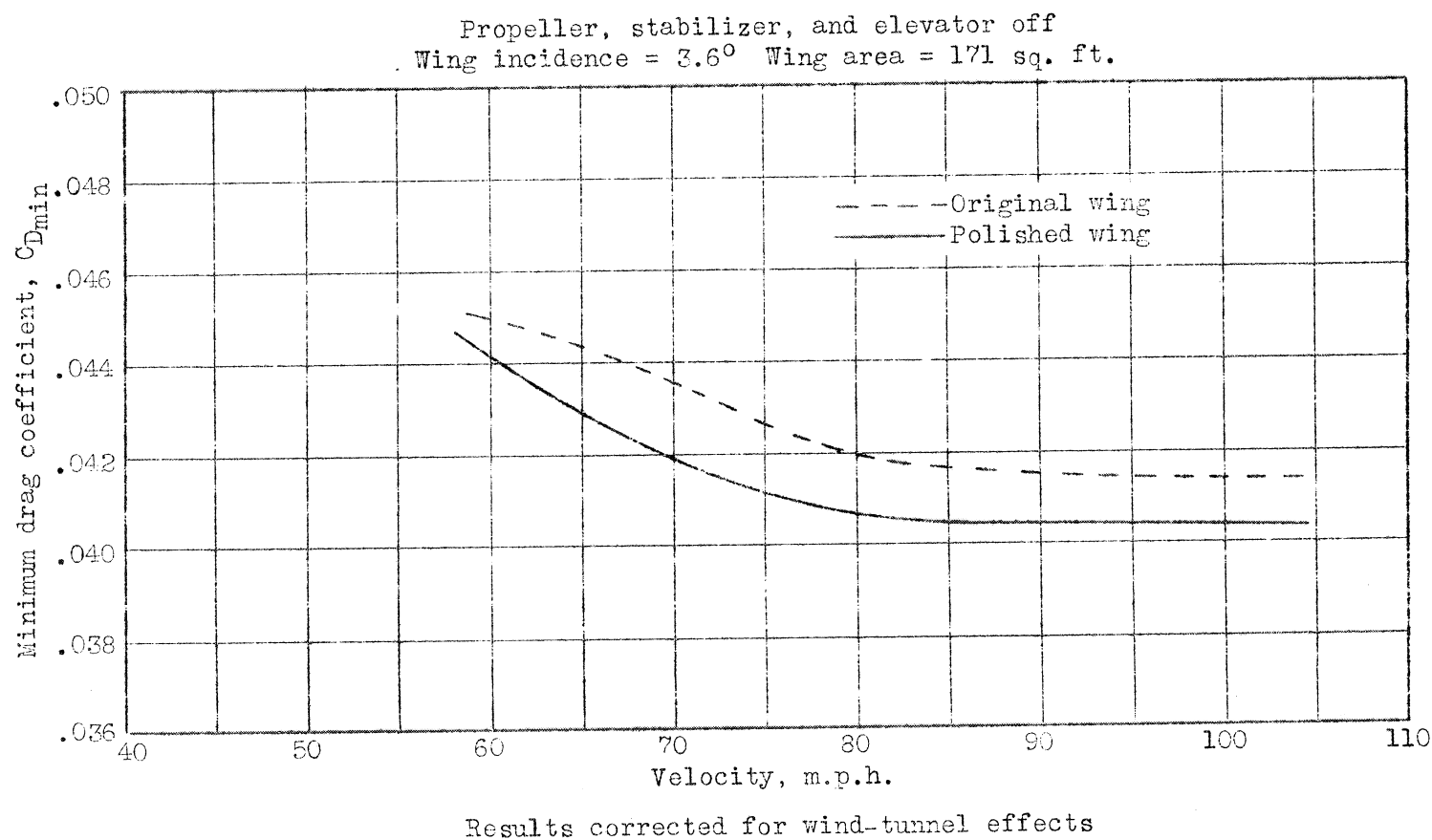


Figure 6.—Scale effect on C_{Dmin} for Fairchild F-22 with original and polished wing surfaces.

